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INFORMATION CIRCULAR

GEOPHYSICAL ABSTRACTS

NO. XXII

BY

FREDERICK W. LEE

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INFORMATION CIRCULAR

DEPARTMENT OF COMMERCE -- BUREAU OF MINES

GEOPHYSICAL ABSTRACTS[1]

No. 22

Compiled by Frederick W. Lee[2]

TABLE OF CONTENTS

	Page
1. Gravitational methods	32
2. Magnetic methods	34
3. Seismic methods	37
4. Electrical methods	40
5. Radioactive methods	42
7. Unclassified methods	46
8. Geology	52
9. New Books	57

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1. GRAVITATIONAL METHODS

(42) A REDETERMINATION OF THE CONSTANT OF GRAVITATION

By Paul R. Heyl

Bureau of Standards Journal of Research, vol. 5, No. 6, 1930, pp. 1243-1291.

Contents of the article:

I. Introduction: 1. The nature of the constant of gravitation; 2. Summary of earlier measurements; 3. Work of Boys; 4. Work of Braun; 5. Organization of the present work.

II. Plan and method.

III. Description of apparatus: 1. Observation room; 2. The large masses; 3. The supporting system; 4. The small masses; 5. The moving system; 6. The container; 7. The optical system; 8. Measurements of time; 9. Measurements of length.

IV. Mathematical theory: 1. The attraction of a finite cylinder at any external point; 2. Formula for time of swing.

V. Method of observing: 1. Centering adjustments; 2. Length measurements: a. horizontal; b. vertical; 3. Time measurements.

VI. Computations.

VII. Results: 1. Gold balls; 2. Platinum balls; 3. Glass balls; 4. Mean value; 5. Discussion of results.

VIII. The specific attraction of platinum and glass.

IX. Summary and general conclusions.

Author's abstract reads as follows: "A redetermination of the constand of gravitation has been made, using the torsion balance in vacuum. The large masses were steel cylinders weighing about 66 kilograms, and the small masses spheres of gold, platinum, and optical glass. The final result obtained is 6.670×10^{-8} cm^3 g^{-1} $sec.^{-2}$.

"While the results obtained appeared to differ slightly with small balls of gold, platinum, or glass, it was shown by a special experiment with the form of torsion balance used by Eötvös that this is not to be attributed to difference in material."

Fourteen figures and 20 tables illustrate the article.--W. Ayvazoglou.

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(43) GRAVIMETRICAL OBSERVATIONS OF THE BEREKEY OIL REGION DURING THE YEARS 1927 AND 1928 (IN RUSSIAN)

By S. P. Poletajev

Neftianoe Khoziaystvo, vol. 19, No. 10, 1930, pp. 385-392.

The problem of the gravimetrical survey of the Berekey oil region consisted of investigating the anticline fold and establishing the structure of the dome of the foraminiferous layers at the top of which a petroleum horizon was known. This question could not be solved satisfactorily by geologists, owing to the absence of outcrops and insufficient correctness in old geological maps.

The data obtained by gravimetrical survey did not agree with the old representation of the geological structure of the region of Berekey and the direction of the axis of the anticline was found to be different from that expected by geologists. The results of the gravimetrical survey are given in two maps, a series of crosscuts and schemes showing the structure of the Berekey dome as based on the data obtained during 1927 and 1928.

The following conclusions were drawn:

1. It was proved by the gravimetrical work that the geological structure of the region of Berekey was more complicated than could be expected on the basis of the data obtained from drilling.

2. There is a break of foraminiferous layers along the anticline axis not only in the territory of the Berekey petroleum field but also to the north of it.

3. The foraminiferous layers in the region of the oil fields are not distributed in accord with chalk and probably are separated from it by less solid masses (clays).

4. In order to explain the inconstancy in the difference of the mean densities of masses situated above and below the top of the foraminiferous layers, it must be assumed that the foraminiferous layers in the region of Berekey are divided into thin scales.--W. Ayvazoglou.

(44) ELEMENTS OF ISOSTASY -- OBSERVATIONS AND INTERPRETATION

By William Bowie

Scientific Monthly, August, 1930, pp. 163-176.

Taking into consideration the importance of isostasy as a branch of geophysical science, Bowie describes in this article its elements, observations, and interpretation under the following headings: 1. Measuring of isostasy; 2. Isostasy in India (J. Pratt and G. Airy); 3. Deflections from the vertical and their causes; 4. Isostasy in the United States; 5. Maintenance of isostatic equilibrium; 6. The earth a yielding mass; 7. Study of gravity anomalies by grouping stations; 8. Explanation of gravity anomaly;

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9. Studies of isostasy in Canada; 10. Determination of depth of compensation; 11. Horizontal extent of compensation; 12. denudation and sedimentation; 13. Mountain formation; 14. Relation of gravity anomalies to geological structure.

The author concludes that much more could be said in regard to the importance of keeping isostasy constantly in mind when one tries to solve the great structural and dynamic problems of geology; and that undoubtedly the literature of the future will treat isostasy at even greater length than has been the case in the past.--W. Ayvazoglou.

(45) ISOSTATIC COMPENSATION IN RELATION TO GEOLOGICAL PROBLEMS

By George R. Putnam

The Journal of Geology, vol. 38, No. 7, 1930, pp. 590-600.

The bearing of gravity results on general geological problems is made more clear by recognizing the fact that complete local isostasy is impossible, and that such an assumption leads to appreciable errors in gravity anomalies in mountainous regions. The horizontal and vertical distributions of isostatic compensation are interrelated, and should be studied together. The ranges of assumptions as to both are stated, with the probable limits. The truth of regional instead of local isostasy has important bearings on geological deductions, and makes the gravity results more consistent with other geological evidence as to the earth's crust.--Author's abstract.

2. MAGNETIC METHODS

(46) DIE MAGNETISCHEN EIGENSCHAFTEN DER ERUPTIVGESTEINE

(MAGNETIC PROPERTIES OF ERUPTIVE ROCKS)

By Kurt Puzicha

Zeitschrift fuer praktische Geologie, vol. 38, No. 11, 1930, pp. 161-172, and No. 12, 1930, pp. 184-189.

Contents of the article:

1. Introduction.
2. Critical consideration of methods used so far, as well as of the results.
3. Stating of the problem.
4. Arrangement of the experiments: (a) theory; (b) constructive data; (c) adjustment.
5. The results: (a) general; tabular classification of the results of measurements; (b) the dependence of the susceptibility on the field strength; (c) the dependence of the susceptibility on the mineral components of the rocks; (d) the dependence of the coercive force and of the remanence on the mineral components of the rocks.

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The author's summary of the article reads as follows:

With the aid of a sensitive ballistic measurement process the general magnetic properties of eruptive rocks were examined on a large number of samples.

It was established that:

1. The susceptibility was independent of the field strength only in a small part of the rocks examined.

2. The susceptibility decreased with the increase of the field strength only in exceptional cases; in most cases it increased with the increase of the field strength. This increase reached about 230 Gauss, almost 180 per cent (65 per cent on the average).

3. The character of the susceptibility depended mainly on the content of magnetite; the increase was proportionally smaller in magnetic pyrites. A conclusion on the amount of susceptibility could not be drawn from the quantitative determination of the content of magnetite only; the size of grains was to be taken into consideration also.

4. The grade of magnetizability did not depend on the content of titanium in the magnetite; ilmenite did not prove to be magnetizable.

5. The coercive force amounted to several hundred Gauss. It depended mainly on the content of iron oxides, magnetic pyrites, and titanium-free magnetite. Titanium magnetite possessed high susceptibility but only limited coercive force.--Author's abstract translated by W. Ayvazoglou.

(47) TERRESTRIAL MAGNETISM FROM THE VIEWPOINT OF THE ENGINEER

By N. H. Heck

Scientific Monthly, April, 1930, pp. 326-341.

A description of instruments and proceedings for obtaining data on magnetic surveying, illustrated by photographs and diagrams, is given.

The difficulties of studying all the different phenomena associated with terrestrial magnetism, as well as the difficulty of completely understanding them and predicting future conditions with accuracy, are mentioned.

The author predicts, that just as in many other fields of physics the investigations started for a definite purpose have produced wholly unanticipated results, the engineers interested in terrestrial magnetism, although not accustomed to undertake problems for which the complete solution is far ahead, as engineering research is established on the basis of immediate or early financial return, will finally also have to engage in research which has no immediate prospect of financial return.--W. Ayvazoglou.

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(48) SUR LE LEVÉ MAGNÉTIQUE DES KARPATES DE SKOLE ET DE LEUR AVANT-PAYS

(ON THE MAGNETIC SURVEY IN THE SKOLE-CARPATHIANS AND THEIR FORELAND)

(IN POLISH)

By E. Stenz and H. Orkisz

Compte Rendu du 1-er Congrès de la géologie du pétrole à Lwow, 14-15 December, 1929, pp. 97-103.

Two magnetic surveys were carried out in the Skole-Carpathians during 1929: one absolute and one relative. The absolute survey has been carried out on an area of about 4,050 square kilometers within the limits of the 1 : 75,000 maps of Drohobycz, Skole, Bolechów and Zydaczów.

Two dip-needles manufactured by Chasselon in Paris and one magnetic theodolite (small model) were used for the measurements. The distance between the points of magnetic inclination was 4 kilometers, that between the points of the horizontal component 6 kilometers, and between the points of declination 6 kilometers.

In general there were made: 248 measurements of inclination, 65 measurements of the horizontal component, and 35 measurements of declination. All the results were reduced to the same epoch: 1928.5.

The relative survey has been carried out for the purpose of prospection. It consisted of 990 points of measurements of the vertical component carried out within the limits of the polygon Stryj-Stebnik-Synowódzko-Bolechów-Zurawno-Zydaczow-Stryj. The density of the points was equal to 1 kilometer. Schmidt's magnetic vertical balances were used for the observations.

Records obtained with the Askania-Werke magnetograph, installed in Daszawa, near Stryj, were used for the reduction of the results of measurements.

Maps showing (1) the horizontal component of the magnetic field, (2) the inclination, and (3) the anomalies of the inclination are added to the article.

The magnetic survey shows an interesting agreement between the course of the isodynamics and the direction of the Carpathian "skibas" (blocks driven one upon the other in the direction, in this region, from southwest to northeast).--Author's abstract translated by W. Ayvazoglou.

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(49) RÈGLES PRATIQUES POUR L'EMPLOI DU MAGNÉTOMÈTRE DANS LES PROSPECTIONS GÉOPHYSIQUES

(PRACTICAL RULES FOR THE USE OF THE MAGNETOMETER IN GEOPHYSICAL PROSPECTING)

By M. C. Alexanian

Annales de l'office national des combustibles liquides, vol. 5, No. 4, 1930, pp. 677-702.

Contents of the article:

Introduction.

Sources of error arising from: (1) construction; (2) observation; (3) natural causes.

I. Errors arising from construction: (1) Errors in construction; (2) displacement of the center of gravity of the magnetic system; (3) displacement of the zero point of the scale; (4) determination of the constants. Scale-constants (vertical component, horizontal component); (5) temperature constants; (6) variation of the horizontality of the apparatus; (7) conditions of the knife-edges.

II. Errors arising from observation: (1) Choice of stations; (2) setting up of the instrument; (3) position of the operator; (4) carrying out of measurements; (5) reading of the scale; (6) determination of the east-west magnetic direction. Influence of the bad orientation of the instrument; (7) final calculations.

III. Errors due to natural causes: (1) Displacement of geographic coordinates; (2) daily variations; (3) magnetic storms; (4) electric currents.

IV. Criticism of the results of measurements: (1) Accuracy of measurements; (2) agreement between the points of measurement; (3) magnetic profiles; (4) verification profiles; magnetic maps; (5) representation of numerical operations; (6) number of stations which can be completed during one day.

The different sources of error which may enter into the course of operations during a magnetic survey, as enumerated in the contents above, are discussed.--W. Ayvazoglou.

3. SEISMIC METHODS

(50) EARTHQUAKES, A CHALLENGE TO SCIENCE

By N. H. Heck

Scientific Monthly, August, 1930, pp. 113-126.

After a brief description of a few different types of earthquakes, which may serve for the purpose of illustration, the author discusses the

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challenges to science presented by them, the first of them being the cause of earthquakes. Concerning the relation of volcanoes to earthquakes, the author says that the volcano seemingly is a localized and rather superficial phenomenon as compared to the earthquakes, that generally earthquakes are due to the slipping of two rock surfaces on one another, and that it is peculiarly helpful to study the effect at the surface. Some examples supporting this supposition are given.

The necessity for accurate determination of the positions and elevations of fixed points in order to study the surface effects caused by earthquakes is mentioned.

The method of attacking the problem of studying the point of origin of an earthquake by measuring the time of travel of waves produced by large explosions, since in this case the point of origin is known, has resulted in the development and confirmation of the important earthquake wave theory. Principal earthquake waves are discussed and their paths shown in figures. The theory of isostasy is mentioned and illustrated by a figure. Two maps, one showing the places of known earthquakes of the United States and another the distribution of seismological stations of the United States and adjacent Canada are added.

The last part of the article deals with instruments for recording earthquakes. Photographs of the Wood-Anderson torsion seismometer and the Wenner seismometer, as well as the record produced by the latter, are given.--W. Ayvazoglou.

(51) ON THE RELATION BETWEEN THE SUNSPOT NUMBER AND THE DESTRUCTIVE EARTHQUAKES IN JAPAN (IN JAPANESE)

By Takeo Takayama and Takeo Suzuki

Bulletin of the earthquake research institute, Tokyo Imperial University, vol. 8, No. 3, 1930, pp. 364-374.

The present investigation is a statistical study on the relation between sunspot activity and the destructive earthquakes in Japan (Formosa excluded) for 318 years from 1608 to 1925. (Time and space distribution of destructive earthquakes is shown in a figure.) The method of this investigation is that the number of destructive earthquakes which occurred for three years containing the year of sunspot maximum or minimum and compared to the same in the other years, have been counted and reduced to the frequency in an equal duration, which at least were represented by the percentage frequency. Similarly the earthquakes percentage for five years of sunspot maximum or minimum was calculated.

The values of percentage given in four tables in the text are the mean values of these two cases. The authors took statistics dividing the whole time interval into two or four and also the space into three zones, i.e., Omori's inner (Japan Sea side) and external (Pacific side) seismic zones and the inland zone of earthquakes which is the aggregate of several local seismic zones between the above two. The result obtained is summarized as follows:

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1. The authors could not find any noteworthy relation from the statistical data taken over the whole Japanese area (Table I).

2. When, however, the three seismic zones are considered separately, there exist noteworthy relations, that is: (1) In the inner seismic zone the earthquakes occurs more frequently in the vicinity of the sunspot maximum; (2) in the external seismic zone, on the contrary, the earthquakes occurs more frequently in the vicinity of the sunspot minimum; and (3) in the inland or middle seismic zone the relation is not noteworthy (the relations are shown in figures). These facts suggest some possible relation in connection with the shift of the zone of the atmospheric high pressure.

3. On the cyclicity of the destructive earthquakes in Japan for from 660 to 1925, the curves of fluctuation of the seismic frequency have been constructed by taking various time intervals as unit of time in which the frequency is counted.

Each curve showed the apparent cyclic nature with its own period, which is found to be three or four times as long as the assumed unit interval as shown in a table. This clearly shows that the apparent periodicity is not the real one but is subjected to the accidental phenomena completely investigated by Prof. T. Terada.--Author's abstract.

(52) RESULTS OF ELASTIC-WAVE SURVEYS IN CALIFORNIA AND ELSEWHERE

By Frank Rieber

Bulletin of the American Association of Petroleum Geologists, vol. 14, No. 12, 1930, pp. 1557-1571.

The author's abstract reads as follows:

"Geophysical exploration in loosely consolidated materials presents a problem different from similar surveys in areas where there is a marked differentiation between beds. However, even in these loosely consolidated materials, velocity of wave transmission varies in general with depth of original overburden, and correlations based on this fact have been found reliable. Apparatus has been specially developed to meet the requirements of operation in such materials."

The question is discussed under the following headings:

1. Relation of lithology to velocity characteristics;

2. Relation of velocity to depth of original overburden;

3. Accuracy requirements in mapping loosely consolidated sediments;

4. Special features of interpretation of results;

5. Requirements for apparatus for mapping loosely consolidated materials.

Sixteen figures illustrate the article.--V. Ayvazoglou.

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(53) THE SCREENING OF SOUTHEND FROM GUNFIRE

Editorial note

Engineering, vol. 130, No. 3387, 1930, pp. 731-732.

The mechanism by which velocity and temperature gradients cause the refraction of sound is discussed. The basis of refraction is, briefly, that the speed of sound propagation is increased by use of air temperature and increase of wind speed. If a sound wave-front be imagined to impinge obliquely on a stratum of air in which the temperature rises with altitude, the upper part of the wave, which penetrates first into the higher-temperature region, travels faster then the lower part, and the inclination of that portion of the wave to the horizontal is increased. If the instantaneous direction of propagation is normal to the wave-front, the sound is gradually refracted toward the earth. Similarly, if the wind component in the direction of the sound increases with height, the waves are refracted downwards. Conversely, if the wind and temperature gradients be such as to reduce the speed of sound as altitude increases, the wave-front is refracted upwards. These effects are illustrated by diagrams. A formula for the height of the acoustical shadow for a certain distance from the source of sound is derived.

An example of the application of the existing approximate methods concerning acoustic investigations are given by Dr. W. S. Tucker in connection with the screening of the north side of the Thames Estuary from the noise of 16-inch gunfire practice in the Isle of Grain.

Experiments with seismographs showed that no appreciable disturbance was transmitted through the ground. Therefore investigations of the "onde de choc" (sound due to the compression wave at the nose of a high-velocity projectile) were carried out. For the prediction of suitable firing conditions photographic records of gun reports were taken by sound ranging apparatus at three stations along the Southend front. The records are reproduced in figures.

In order to facilitate the forecasting of safe firing conditions, Tucker devised a series of celluloid disks, shaped like the shadow diagrams shown in three figures. To ascertain meteorological conditions, the approximate wind gradient disk is placed on a map of the district, with its center at the gun, and oriented to the wind direction prevailing at the time. The approximate temperature gradient disk is superimposed, and the height of the resultant shadow at the range (5 miles) for which the disks are designed may be read off to scale.--W. Ayvazoglou.

4. ELECTRICAL METHODS

(54) ELECTRICAL PROSPECTING

By Allen A. Rogers

The Tech Engineering News, vol. 11, No. 6, 1930, pp. 218-219 and 243.

After a brief mention of geophysics as an agency of prospecting for minerals and oil, the author describes the application of electricity for

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geophysical prospecting. The method of equipotential lines and that of induction are discussed. A map of current and equipotential lines and a plan and profile views of an ore deposit located by electrical prospecting are given. In conclusion Rogers points out that geophysical prospecting, being a new tool for the geologist and mining engineer, can be used only by those trained in this art. As an aid to extending the scope of the results of geological studies, to finding and tracing certain concealed features of the earth's crust, it is invaluable and its use is bound to increase.--W. Ayvazoglou.

(55) MESSUNG DER ELEKTRISCHEN ERDEIGENSCHAFTEN ZWISCHEN 20 UND 2.10^7 HERTZ. (CYCLES PER SECOND)

(MEASUREMENT OF ELECTRICAL PROPERTIES OF THE SOIL BETWEEN 20 AND 2.10^7 HERTZ)

By M. J. O. Strutt

Elektrische Nachrichten-Technik, vol. 7, No. 10, 1930, pp. 1-8.

Contents of the article:

1. Importance of the electrical properties of the soil.

2. Measurements between 20 and 6.10^5 Hertz.

3. Arrangements for measurements between 6.10^5 and 2.10^7 Hertz.

4. Calibration of the tubular voltmeter in case of short waves.

5. Results of measurements in case of short waves.

6. Discussion of the results.

7. Summary.

The author measured the electrical conductivity between 20 and 5.10^5 Hertz, as well as the electrical conductivity and the dielectric constant between 6.10^5 and 2.10^7 Hertz (undamped) in a moderately moist meadow ground. The following results were obtained:

1. The conductivity increased between 20 and 500 Hertz to about 30 per cent (polarization) and then remained practically constant up to 2.10^7 Hertz.

2. This frequency course remained approximately valid also in case of a slight change of the water content in the soil.

3. Contrary to the author's expectation, after a rain the damping influence of the soil upon the electrical wire waves decreased for waves below 200 meters.

4. The dielectric constant increased, owing to the rain, relatively more than the conductivity -- this explained the conditions mentioned in No. 3.

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5. The dielectric constants were about 10 and 15 (on the same ground after rain). Between 10^6 and 2.10^7 Hertz they depended on frequency to a slight degree only.--Author's abstract translated by W. Ayvazoglou.

(56) ELECTRICAL PROSPECTING IN THE REGION OF GROZNY (IN RUSSIAN)

By D. Golubiatnikov

Azerbeidjanskoe Neftianoe Khoziaystvo, vol. 10, No. 10, 1930, pp. 51-54.

The author describes the application of Schlumberger's method for investigation of rocks along the drilled holes ("electrical logs") in the region of Grozny. Field work carried out by Schlumberger's method of electrical prospecting is discussed. The methods are briefly described. The results are summed up as follows:

Investigation of rocks along the drilled holes by the method of electrical logs (carrotage) proved to be very satisfactory; several oil-bearing and water-bearing horizons not mentioned in the geological structural maps were established. Schlumberger's method of electrical prospecting in places covered with alluvium where good results can not be secured by digging is the sole means by which a quick answer on the conditions of the structure of the subsoil can be obtained.--W. Ayvazoglou.

(57) ELECTRICAL PROSPECTING IN THE REGION OF GROZNY (IN RUSSIAN)

By D. Golubiatnikov

Za Neftianuiu Piatiletku (for the 5-year oil industry program), No. 11-12, 1930, pp. 11-14.

The author describes the electrical prospecting work carried out according to Schlumberger's method in the region of Grozny. Six parties were intrusted with the examination of rocks along the holes, investigation of sections of the holes, establishment of oil-bearing and water-bearing horizons, determination of the structural details of the Novo-Grozny and Staro-Grozny regions, search for new structures in the area adjoining the industrial regions and finally with the establishment of the possibility of finding the raising of the anticline toward the great plain to the north of the industrial region. All these geological tasks were solved by electrical prospecting very successfully.--W. Ayvazoglou.

5. RADIOACTIVE METHODS

(58) KENNELLY-HEAVISIDE LAYER HEIGHT OBSERVATIONS FOR 4,045 AND 8,650 KC.

By T. R. Gilliland

Bureau of Standards Journal of Research, vol. 5, No. 5, 1930, pp. 1057-1068.

Virtual heights of the Kennelly-Heaviside layer as measured by the radio-echo method are reported for 4,045 and 8,650 kc. The report covers daytime observations made each week between January 16 and June 19, 1930. Two

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evening tests are also described. Curves are given comparing heights with sunspot numbers and magnetic character. Records taken on April 28, 1930, the day of the solar eclipse, are shown.--Author's abstract.

(59) RADIOACTIVE PROPERTIES OF ROCKS, SOILS, CRUDE OIL AND WATERS FROM SOUTHERN CALIFORNIA

By J. Lloyd Bohn

Journal of the Franklin Institute, vol. 210, No. 4, 1930, pp. 461-472.

This paper includes measurements on waters from Lake Arrowhead, Arrowhead Hot Springs, Harlem Hot Springs, the Pacific Ocean, and from numerous wells and tunnels of the Pasadena and neighboring water supplies. It also includes measurements on rocks, soils, and crude oil.

The activity of the water of Lake Arrowhead is found to be one hundred times smaller than the minimum that could be detected with the electroscopes used for cosmic ray measurements by Millikan and Cameron. This lake is, therefore, very suitable for cosmic ray measurements. The Pasadena wells yield waters approximately one thousand times as active as the Lake Arrowhead water, thus making the Pasadena reservoirs unsuitable for these measurements.

The ratio between the activity of the soil at Lake Arrowhead and that of the soil from the Institute campus, as obtained by Millikan and Cameron from their cosmic ray data, is in good agreement with the results in this report. However, in this report no account is taken of the γ-radiation due to the thorium series, which is of the order of, and probably slightly exceeding, that due to the radium series. If the Th/Ra ratio is constant, as is usually the case, then the results of the two methods are in good agreement.

The average radium content of the acid intrusive rocks in the vicinity of Devil's Gate Dam, Pasadena, is found to be 2.3×10^{-12} grams of radium per gram of rock.

Pasadena tap water contains about 1 eman or 1×10^{-10} curies per liter, while the average of the sources is about five times as great. The radium emanation found in crude oil was of the same order of magnitude as that found in well water.

Carnotite when fused with carbonates at about 1,000° C. loses part of its Ra — probably as a sublimate of $RaBr_2$.

Such a loss in fusing rocks might account for the discrepancy between the solution and fusion methods as found by J. Joly.--Author's abstract.

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(60) UNTERSUCHUNG UEBER DIE BEZIEHUNG DER HÖHENSTRAHLUNG ZU ERDMAGNETISCHEN STÖRUNGEN

(INVESTIGATION ON THE RELATION OF PENETRATING RADIATION TO EARTH-MAGNETIC DISTURBANCES)

By Walter M. H. Schulze

Physikalische Zeitschrift, vol. 31, No. 22, 1930, pp. 1022-1025.

As long as the penetrating radiation was considered to be a very hard γ-radiation no relation between the intensity of radiation and the earth-magnetic phenomena was expected theoretically; therefore no experimental investigation has been made in this line. This question became of practical interest after the results obtained by investigations carried out by Bothe and Kohlhörster with Geiger's electron counter, according to which there were found, in additionto γ-rays, also rays of very high penetration, that is very rapid corpuscular rays, probably of the type of β-rays.

In this article the author gives the results of his studies, together with those of Corlin, concerning the exact calculation of correlation between the intensity of penetrating radiation and single earth-magnetic elements.

At the disposal of the author was a series of penetrating radiation-intensity measurements carried out by Corlin, as well as observations on the most important meteorological, magnetic, and aurora borealis phenomena in Abisco made from October 16, 1929, to January 12, 1930.

The measurements were made with Büttner's radiation apparatus A of Kohlhörster's type III. The results of the measurements are given in a series of tables.

A noticeable influence of magnetic declination disturbances could not be established on the basis of the investigations made. The question of the effect of the changes of the horizontal and vertical intensity upon ionization will be taken up for study.

In conclusion the author mentions briefly the relations to aurora borealis as established by investigations made by him.--W. Ayvazoglou.

(61) SCATTERING OF HARD γ-RAYS

By C. Y. Chao

The Physical Review, vol. 36, No. 10, 1930, pp. 1519-1523.

In a previous study of the absorption coefficient of hard γ-rays in various elements (Chao, Proc. Nat. Acad. Sci., vol. 16, 1930, p. 431) the author has found that the absorption coefficient of light elements was predicted fairly well by the Klein-Nishina formula, which assumes that the removal of the energy from the primary beam is entirely due to Comoton scattering of the extranuclear electrons. For heavy elements, however, the experimental

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value was much larger than was to be expected from the Klein-Nishina formula or any other. Two causes can be suggested to explain this additional absorption: (a) It may be an extranuclear phenomenon due either to an ordinary photoelectric absorption or a breakdown of the Klein-Nishina formula for Compton scattering in these elements; (b) it may also be a nuclear phenomenon, such as the scattering by particles inside the nucleus or any other nuclear absorption (like the excitation of the photoelectric effect occurring there). In an attempt to obtain more information about these questions, a study of the scattered rays has been made.

The results obtained from this study are summed up by the author as follows:

Measurements have been made on the scattering of γ-rays from Th C by Al and Pb. For Al the scattering is, within experimental error, that predicted by the Klein-Nishina formula. For Pb additional scattered rays were observed. The wave-length and space distribution of these are inconsistent with an extranuclear scatterer, and hence they must have their origin in the nuclei.--Author's abstract.

(62) ON THE QUESTION OF THE CONSTANCY OF THE COSMIC RADIATION AND THE RELATION OF THESE RAYS TO METEOROLOGY

By Robert A. Millikan

The Physical Review, vol. 36, No. 11, 1930, pp. 1595-1603.

Mean cosmic-ray intensities have been measured with much precision both at Pasadena, Calif. (latitude 34), and at Churchill, Manitoba (latitude 59), the latter a distance of 730 miles from the North magnetic pole.

1. The observed equality in these intensities indicates that these rays enter the earth's atmosphere as photons rather than as streams of electrons.

2. Evidence is presented that the incoming rays are of a uniform intensity in all directions and in all latitudes, the small and apparently erratic fluctuations found by many observers at different stations arising simply from eruptions, waves, or ripples which change the thickness of the atmospheric blanket interposed between the source and the observer.

3. The cosmic-ray electroscope thus acquires significance as a meterological instrument.

4. The influence of these rays in the maintenance of the earth's charge is considered.--Author's abstract.

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(63) THE SIGNIFICANCE OF RECENT COSMIC-RAY EXPERIMENTS

By R. A. Millikan and I. S. Bowen

Proceedings of the National Academy of Sciences, vol. 16, No. 6, 1930, pp. 421-425.

The particular recent cosmic-ray experiments, the significance of which is discussed in this article, are (1) as yet unpublished results of work by Millikan and Cameron on absorption coefficients of cosmic rays on high mountains and at great depths in mountain lakes, (2) recent experiments by Millikan and Bowen on the absorption of gamma rays in mountain lakes, (3) new experiments in the Norman Bridge Laboratory by Chao on gamma-ray absorption, and (4) experiments by Bothe and Kohlhörster and by Curtiss on coincidences obtained with the use of cosmic rays in Geiger-Müller ionization counters.

The authors revealed, in accord with Regener's finding, a very weak, very penetrating radiation at great depth beneath the surface of Gem Lake, 300 feet and more, due, according to the atom-building hypothesis, to the formation of the heavy and rarer elements out of hydrogen. They also revealed at great altitudes on mountain peaks the steeper ionization-depth curve predicted by the Klein-Nishina formula from the hypothetical formation of helium out of hydrogen.

The penetrating power of the softest of the cosmic rays was found to be roughly five times that of these gamma rays of Th C^{11}. This relative penetrating power corresponds, according to the Klein-Nishina formula, to an energy of the softest cosmis rays about ten times that of these hardest gamma rays, and this is also the relative energy of the gamma rays from Th C^{11} and the energy of the softest cosmic ray as computed from the Einstein equation, the Aston curve and the assumption that the softest cosmic ray is produced by the formation of helium out of hydrogen. These facts support strongly the atom-building theory.

The experiments are of great importance because they show that beta rays of the enormous energies involved in the cosmic rays have a penetrating power of the same order of magnitude as the cosmic rays themselves. This is a new and an important discovery, and it is the whole significance of these experiments.

Thus if energies of considerably more than 500 million volt-electrons could be established, then the theory of atom building in interstellar space as the source of the cosmic rays would have to be abandoned.--W. Ayvazoglou.

7. UNCLASSIFIED METHODS

(64) GEOPHYSICAL NOTES ON CALIFORNIA AREA

By Paul B. Whitney

The Oil and Gas Journal, vol. 29, No. 32, 1930, pp. 32, 146-153.

The author expresses his confidence that geophysical methods will be extensively employed in California for solution of unknown structural

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conditions, particularly in the San Joaquin and Sacramento Valleys, as nearly all of the geophysical methods (electrical, electromagnetic, torsion balance, seismograph, and magnetic) have given practical results in California.

Some results of geophysical surveys carried out in California are explained, based on curves, graphs, isograms, and profiles given in the article.

The outlook for the future application of geophysical methods in California is especially promising, taking into consideration that the cost of establishing and maintaining an efficient geophysical department is less per year than the cost of one dry hole, thus, with expectation of but one new discovery in two years time, the maintenance of a strong geophysical department is economically more than justified for any oil company.—W. Ayvazoglou.

(65) GEOPHYSICAL PROSPECTING IN 1930

By Donald H. McLaughlin

Mining and Metallurgy, vol. 12, No. 289, 1931, pp. 22-26.

The increasing use of geophysical methods by geologists and engineers during the past year is mentioned as a significant and an encouraging sign.

The relation of geophysical and geological work has become increasingly clear.

A slump in geophysical exploration was noticeable in the Gulf Coast region during the past six months on account of the contrast to the great activity at the beginning of the year. The subsequent sudden decrease in geophysical prospecting in this region can probably be attributed chiefly to the depression in the oil business, rather than to discouragement over results, but to an important extent it was due to the completion of surveys in the most promising areas.

The efforts to secure records from greater depths with the seismic methods have brought about many revisions leading to greater accuracy in time-distance observations. Commercial magnetometer surveys have been greatly restricted during the past six months, but the usual steady accumulation of records from scientific work in this field still continues.

Electrical prospecting during the year continued to be applied in a wide range of geological problems, from structural work in petroleum fields to foundation investigations for dams. In the search for metallic ores, satisfactory results continue to be reported from districts where conditions are suitable for effective work.

In conclusion the author mentions the following three meetings held during the year that were of particular importance with respect to presentation of papers on geophysical prospecting and for the exchange of information: (1) The American Institute of Mining and Metallurgical Engineers, (2) the American

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Association of Petroleum Geologists, and (3) the Fourth General Assembly of the International Union of Geodesy and Geophysics held in Stockholm, Sweden.

The widening interest in geophysical prospecting in England, the publication of the special supplement to Gerland's Beiträge zur Geophysik, entitled Ergänzungshefte fur Angewandte Geophysik, the appearance of the Boletin de la Asociacion Geofisica de Mexico, as well as the work of the U. S. Bureau of Mines, are mentioned.--W. Ayvazoglou.

(66) GEOPHYSICAL PROSPECTING POSSIBILITIES FOR TIN IN THE FEDERATED MALAY STATES

Editorial note

The Mining Journal, London, vol. 170, No. 495b, 1930, pp. 658-659.

This is a portion of the report on the application of geophysical methods of prospecting for the investigation of tin ores. The report was made by Mr. Broughton Edge based on his visit in the Federated Malay States from July 22 to August 2, 1929. It embodies the conclusions arrived at after discussion with the Director and other members of the F. M. S. Geological Survey Department, together with visits to the principal tin producing centers in Perak and Selangor.

The following kinds of tin deposits were investigated:

1. Alluvial and residual tin deposits.

2. Sulphide bearing tin-pipes in limestone.

3. Sulphide bearing tin lodes in granite.

4. Sulphide bearing tin lodes in schist.

The conclusions drawn read as follows:

Geophysical methods of prospecting, in their present stage of development, can not be applied extensively to the mining fields in Perak and Selangor which were visited -- or to those in other parts of the F. M. S. where the modes of occurrence are similar.

In the cases of alluvial and eluvial tin deposits there is little prospecting of success by any geophysical method, but the sulphide bearing tin lodes and pipe deposits occurring in granite, schist, and limestone present more favorable conditions. There is good reason to believe that certain of the geoelectrical methods would be effective in locating them.

In particular, important possibilities are presented by the sulphide bearing tin-pipes which are characteristically developed in the limestone country along the eastern flank of the Kledang Range (Kinta) and if arrangements could be made for a geoelectrical examination of

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the ground which extends between Lahat and Selibin (Kinta district) there would be good prospects of success.

In some of the tin fields it is possible that occasions may arise in which data are required regarding the depth and configuration of the limestone surface over large areas, in which the depth of alluvium is too great to permit a thorough boring compaign (e.g. 200 feet or more). Under such circumstances it is likely that a seismic survey would prove effective.

In the Batu Arang coal field it is probable that some useful work could be carried out by the gravimetric method. This would be limited, however, since the topography over the great part of the field is too rough to permit a general application of the system.--W. Ayvazoglou.

(67) LES HOMOLOGIES PODOLIENS-KARPATIQUES; LEUR APPLICATION AUX RECHERCHES GÉOPHYSIQUES DANS LA ZONE SUBKARPATIQUE

(PODOLIA-CARPATHIAN HOMOLOGIES; THEIR APPLICATION TO GEOPHYSICAL INVESTIGATION IN THE SOUTH CARPATHIAN ZONE) (IN POLISH)

By W. Teisseyre

Compte Rendu du 1-er Congrès de la Géologie du Pétrole à Lwow, 14-15 Dec., 1929, pp. 37-65.

After a detailed geological description of the region the author mentions the directions for geophysical investigations based on a series of displacements and warpings in Podolia which, he states, agree with the details in the changes established by recent surveys. The positions of culminations and depressions with regard to the dislocations in the foreland will become valuable by the fact that, after having cancelled the illusory culminations, the comparison of the intervals between the main culminations with those between the great structural lines of the foreland can be established.--W. Ayvazoglou.

(68) DE L'APPLICATION DES MÉTHODES GÉOPHYSIQUES AUX RECHERCHES DE LA GÉOLOGIE DU PÉTROLE DANSLES KARPATES ET L'AVANT-PAYS

(ON THE APPLICATION OF GEOPHYSICAL METHODS OF PROSPECTING GEOLOGICAL STRUCTURE OF PETROLEUM FIELDS IN THE CARPATHIAN MOUNTAINS AND THE FORELAND (IN POLISH)

By E. W. Jančzewski

Compte Rendu du 1-er Congrès de la Géologie du Pètrole à Lwow, 14-15 Dec., 1929, pp. 81-97.

The author reviews the principal methods of geophysical prospecting (gravimetrical, magnetic, radioactive, geothermic, seismic, electrical) and characterizes the kinds of indications which can be furnished by these methods on the nature of the subsoil.

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He discusses the use of the Sterneck pendulum for the study of the distribution of the gravity anomalies in the Carpathian Mountains and the foreland and believes that these investigations will contribute to the determination of the main lines of deep tectonics of these regions, as well as their relationship to the Podolian plateau.

In speaking of the advantages established by the application of the method of artificial seismic oscillations, he emphasizes the importance of combining it with the gravimetrical method in order to obtain a more exact representation of the subterranean structure of the foreland of the Carpathian Mountains.

The other methods are discussed with reservation, owing to the local conditions of the peripheral depression filled up by a series of monotonous Tertiary layers in which very saline underground waters are circulating.--Author's abstract translated by W. Ayvazoglou.

(69) TRAVEAUX EN TERRAIN EXECUTÉS PENDANT L'ANNEÉ 1929

(FIELD WORK CARRIED OUT DURING THE YEAR 1929)

By J. Morozewicz

Bulletin du Service Géologique de Pologne,
vol. 5, No. 3-4, 1930, p. LXXIII.

In Morozewicz's report on field work carried out in Poland during 1929 the following geophysical investigations made under the direction of the geophysicist E. W. Janczewski are mentioned:

1. In Kujawach, near Wloclawka. -- Seismic and gravimetrical methods were applied. Gravimetrical measurements were made at 137 points.

2. In the Carpathians (between Stryj, Bolechow, Rozniatow, Zawoj, Kalusz, and Turza Wielka).--Seismic method of prospecting was used.--W. Ayvazoglou.

(70) PROSPECTING WORK OF THE AZNEFT (IN RUSSIAN)

Editorial note

Azerbeidjanskoe Neftianoe Khoziaystvo,
vol. 10, No. 11, 1930, pp. 145-146.

The results of the geophysical prospecting work carried out during the years 1928, 1929, and 1930 are briefly summed up as follows:

1. Magnetic method: Magnetic anomalies in the region of Nefte-Chala proved to be in a distinct relation to the geological structure of the region. The dependance of these anomalies on the presence of magnetite in the Tertiary sediments is discussed.

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2. Gravitational method: The maximum gravity in the region of Nefte-Chala is due to the presence of the lines limiting very dense and less dense rocks, as well as owing to the presence of faults.

Prospecting work on a large scale is to be carried out during 1931 mainly beyond the Baku region.

Electrical prospecting is to be tried out widely, owing to the fact that the results obtained by the gravimetrical and magnetic methods, applied during the past four years, have not been satisfactory.--W. Ayvazoglou.

(71) NOTE ON A COMPARISON OF SUNSPOT NUMBERS, TERRESTRIAL MAGNETIC ACTIVITY, AND LONG-WAVE RADIO SIGNAL STRENGTH

By L. W. Austin

Journal of the Washington Academy of Sciences,
vol. 20, No. 5, 1930, pp. 73-74.

A figure shows a comparison of the monthly averages of sunspot numbers, terrestrial magnetic activity (horizontal range) measured at Cheltenham, Md., and the daytime ratio field strength of signals received in Washington from transmitting stations at Bordeaux, France (FYL) ($f = 19.5$ kc., $\lambda = 18,900$ m.), and at Nauen, Germany (DFW) ($f = 23.4$ kc., $\lambda = 12,800$ m.).

The resemblance of the sunspot curve to the other three is not clear, but the similarity in the changes in magnetic activity to those in daylight signal strength seems to be unmistakable. The resemblance of the Bordeaux signal curve to that of the magnetic activity seems closer even than the resemblance between the two signal curves. The deep drop of both the magnetic and signal values in November (more rarely in December) is especially striking. This early winter drop in signals has often been noticed, and in the case of transmission between Europe and America, has been sometimes ascribed to the proximity of the signal paths to the area of Arctic darkness. It now appears that this and other seasonal variations both in magnetic activity and east-west long-wave signal strength may be due to common cases.--Author's note.

(72) ON ISOSTASY AND RELATED TOPICS

GEOLOGICAL SOCIETY IN WASHINGTON

Journal of the Washington Academy of Sciences,
vol. 20, No. 18, 1930, pp. 441-458.

Abstracts of the following five articles given before the Geological Society in Washington during the spring of 1930 are published:

1. Some problems of mountain structure and mountain history, by R. Longwell (pp. 441-446.)

2. Isostasy: What gravity measurements reveal, by G. R. Putnam (pp. 446-447.)

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3. Some problems in isostasy, by R. W. Goranson (pp. 447-450).

4. Geotherms, by A. C. Lane, (pp. 450-454).

5. Isostasy from the geological point of view, by R. T. Chamberlin (pp. 454-458).--W. Ayvazoglou.

8. GEOLOGY

(73) PETROLEUM POTENTIALITIES OF GULF COAST PETROLEUM PROVINCE OF TEXAS AND LOUISIANA

By Donald C. Barton

Bulletin of the American Association of Petroleum Geologists, vol. 14, No. 11, 1930, pp. 1379-1400.

A new vista of the petroleum potentialities of the Gulf Coast petroleum province of Texas and Louisiana has been opened by the developments of the past few years. The coastal salt-dome area has been extended eastward to, and across, the Mississippi River. The area of good production has been extended southwestward to Refugio and may be expected to extend to the Rio Grande; it has been extended southward to Clay Creek, which lies in a hitherto practically nonproductive zone, and seems probably to have been extended eastward to Terrebonne Parish, La. The maximum depth of production has been extended to 7,444 feet, and the stratigraphic zone of good production has been extended down into the middle of the Claiborne. Deep and very deep salt domes have great potentialities, are being discovered in great numbers, but have certain drawbacks. The very deep salt ridges are unknown quantities. An enormously thick potentially productive stratigraphic section is present and offers great possibilities for production on such deep structures. A distinct tendency is shown for an increase of the Baumé gravity and gasoline content of the oil with increasing depth and in part with increasing stratigraphic depth. That change foreshadows a progressive change in the mean character of the oil of the future and gives the only suggestion, as yet, of a possible downward limit to production. The general magnitude of the recoverable reserves of oil in the Gulf Coast area of Texas and Louisiana at a shrewd guess is: surely at least, 3,500,000,000 barrels, probably at least 5,500,000,000 barrels and possibly at least 10,000,000,000 barrels.--Author's abstract.

(74) A STATISTICAL EXAMINATION OF THE SENSITIVITY OF A WATER TABLE TO RAINFALL AND IRRIGATION

By B. H. Wilsdon and R. Partha Sarathy

Memoirs of the Punjab Irrigation Research Laboratory, Lahore, vol. 1, No. 1, 1927, pp. 1-51.

The records collected in this article on a series of well observations in irrigated tracts of the Punjab from 1895 to 1926 constitute very valuable data on the sensitivity of a water table to rainfall and irrigation. In the summary of the first part of the article the authors say:

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1. The analysis of well records and irrigation and rainfall statistics enables significant regressions to be established between the distribution of rainfall and irrigation throughout the year, and the annual fluctuations of the well levels.

2. The regression curve shows a constant characteristic in the occurrence of a maximum affect of irrigation and rainfall during the monsoon. A second maximum during the winter months is more variable in incidence as is also the occurrence of negative values of the regression.

3. For variations of the monthly irrigation and rainfall within the range of the standard deviations it is found that on the average approximately one-third of the water added to the surface of the soil during the year percolates to the water table.

4. The application of the regression curves in predicting the effect of restriction if irrigation is indicated.

5. A rough calculation shows that not more than one-third of the annual rise of the water table may be attributed to leakage from main canals and branches.

6. The slow changes in the well levels, when compared with the computed addition to the water table from irrigation rainfall and leakage from canals indicate that a well drained "doab" (land bounded by two rivers) is capable of maintained equilibrium. The steady rise in other canals is largely attributable to the absence of drainage, rather than to excessive percolation load.

In the second part of the article the authors give some calculations, the purpose of which is to obtain a mathematical curve showing the average effect of rainfall and irrigation in each month of the year on the well levels.

The necessary data for the calculation of the regression constants for each distributary are given in the following four tables:

Table I. Yearly values of the June or October series of:

(a) The observed depth of water.

(b) The polynomial value of this depth.

(c) The divergence (δd) of the observed from the polynomial value of D.

Table II. Give the constants of the polynomial fitted to W for the years shown.

Table III. Sume of squares and products.

Table IV. Matrix of co-factors.--W. Ayvazoglou.

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(75) STATISTICAL STUDIES OF THE HISTORIES OF WATER-TABLES AS AFFECTED BY IRRIGATION AND RAINFALL

By B. H. Wilsdon and R. Partha Sarathy

Memoirs of the Punjab Irrigation Research Laboratory, Lahore, vol. 1, No. 2, 1928, pp. 1-24.

In the first part of the article the authors describe the results of an analysis of the relation between annual fluctuations of the water-table and the applied irrigation and rain water for a series of regions. The method adopted was:

1. To weight the data of rain-gage stations and observations wells, so that their records may be as truly representative as possible of the whole area.

2. To combine the weighted rainfall with the recorded irrigation in such a way that the total water applied, assumed uniformly distributed over the area W, may be represented as six independent variables of a fitted polynomial of the fifth order.

3. To eliminate secular changes from the weighted record of well fluctuations by fitting the best exponential curve.

4. To correlate the change in average well level, corrected for slow change, with the constants of the polynomial fitted to the W distribution.

The regression curves so obtained indicate a considerable variation throughout the year in the proportion of water which reaches the water-table from each application. Common features are a high proportion (one-third or more) during the monsoon when the humidity and intensity is high, and a more variable effect during the winter and early spring. The results in general confirm those obtained in a preliminary investigation by a similar method in a previous memoir but are statistically more reliable.

The numerical data are discussed and illustrated by diagrams.

In the second part of the article a detailed mathematical discussion of points arising in the analysis is given.

The necessary data for the calculation of the regression coefficient are given in the following four tables:

Table I gives the yearly values of δd (annual rate of rise of water-table) actual as well as those calculated from the regression formula with the exponential slow changes.

Table II gives the constants of the polynomial fitted to W for the year shown.

Table III. Sums of squares and products of the above-mentioned constants.

Table IV. Matrix of co-factors of the determinants in Table III.--W. Ayvazoglou.

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(76) A STATISTICAL EXAMINATION OF THE DISCHARGE OF THE INDUS AT SUKKUR AND ITS RELATION WITH UPSTREAM SITES

By B. H. Wilsdon and R. Partha Sarathy

Memoirs of the Punjab Irrigation Research Laboratory, Lahore, vol. 1, No. 3, 1929, pp. 1-40.

The work described in this article was taken up at the request of the Indus Discharge Committee in September, 1928. The ultimate aim of the investigation has been defined as the determination of "the history of the water of the Indus and its tributaries during its passage through the Punjab and Sind to Sukkur." The desiderata of any acceptable formula were defined by this committee as follows:

(a) It must satisfy data available,

(b) more completely than any other formula, and

(c) must be capable of forecasting.

The sites at which discharge observations on the Indus and its tributaries were made are shown in a map.

In conclusion the authors emphasize the main deductions made from the statistical results, and distinguish lines along which further investigation appears profitable.

They say:

1. Regeneration appears to be quite definitely a real phenomenon determined by the time elapsed since high floods and to some extent by rainfall and associated humidity.

2. A formula has been developed which appears to be capable of predicting differences in discharge between upstream sites and Sukkur from a knowledge of the upstream discharges and the rainfall. This is of course not a prediction formula in the true sense. It affords hope of a true prediction formula being discoverable if reliable relations between rainfall in the catchments and discharges can be substantiated.

3. It is not at present possible to predict what effect a considerable disturbance in regime by a withdrawal will have at a downstream site although the absence of secular trend in recorded discharges proportionate to the very large increase in withdrawals which has taken place in the Punjab points to the ultimate establishment of regenerative conditions.

4. The probabilities of shortage in supply at Sukkur during the cold weather have been worked out on the assumption that the full Sind indent must be maintained. The withdrawals do not so greatly increase

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the changes of shortage as to put the possibility of accommodation of the small Punjab demands by Sind completely out of court.

Full tabular matter has been collected in the appendix.--W. Ayvazoglou.

(77) A HYDRODYNAMICAL INVESTIGATION OF THE FLOW OF LIQUID IN A SATURATED POROUS MEDIUM SUCH AS A SOIL

By N. K. Bose and B. H. Wilsdon

Memoirs of the Punjab Irrigation Research Laboratory, Lahore, vol. 2, No. 1, 1929, pp. 1-17.

In the introduction to the article Wilsdon points out the difficulties, both theoretical and experimental, in studying the flow of liquids in porous media. The laws applied in hydrodynamics may be expected to aid in understanding and controlling the movements of a water-table, this subject being of great importance to the Punjab. Since the introduction of irrigation the water-table has risen over large tracts at an alarming rate. In some areas waterlogging on an extensive scale has resulted; in others, land once fertile has become saline and unculturable due to the nearness of the water-table to the surface. The further spread of both these evils, results of the same cause, calls for immediate and energetic remedial and preventive measures, neither of which can be confidently designed without considerable advances in theoretical knowledge. Moreover, without such knowledge it will be impossible to devise proper experimental methods. A brief review of applicable methods is therefore given in this article.

The second part of the article deals with applications of the mathematical treatment developed to ascertain simplified problems of practical importance. The mathematical work in this part is due to Bose. It has been constantly kept in view to obtain solutions in such a form that it will be possible to compare model experiments on viscous liquids with observations on the water-table.

Fundamental hydrodynamical equations applicable to the problems are deduced and the relation between the transmission constant of a soil and the viscosity of the model fluid is demonstrated.

Cases of percolation from a line course such as a canal, with and without distributed surface sources equivalent to the rainfall and irrigation load are discussed.

Unsteady motions corresponding with these cases are discussed.--W. Ayvazoglou.

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9. NEW BOOKS

(78) Angenheister, G. Angewandte Geophysik (Applied Geophysics). Bearbeited von H. Haalck, W. Heine, J. N. Hummel, K. Jung, H. Martin, O. Meisser, H. Reich. XII and 556 pages with 253 figures. Price, stitched, R.M. 52; bound R.M. 54. 1930. Akademische Verlagsgesellschaft m.b.H., Leipzig. Contents: Geological bases of applied geophysics, by H. Reich; Gravimetric method of applied geophysics, by Karl Jung; Air-seismics and ground-seismics, by O. Meisser and H. Martin; Magnetic methods of applied geophysics, by H. Haalck; Electrical methods of applied geophysics, by J. N. Hummel and W. Heine; Practical application of electrical methods, by W. Heine; Radioactive methods, by J. N. Hummel.

(79) Haarmann, Erich, Prof. Dr. Die Oszillationstheorie. Eine Erklärung der Krustbewegung von Erde und Mond (The Oscillation Theory; An Explanation of the Movement of the Crust of the Earth and of the Moon). 260 pages, 78 figures, 1 table. Verlag R. Enke, Stuttgart 1930. Price, stitched, R.M. 17.00, bound, R.M. 19.00.

(80) Hermanns, Hubert. Techno-Diktionar, Deutsch-Englisch-Italienisch. (Technical dictionary, German-English-Italian). 432 pages. Berlin, Hubert Hermanns, 1929. Price, $3.75.

(81) Joly, John. The surface history of the earth. 2nd edition. 211 pages, figures 11, map. Oxford press, 1930. Price, $3.50.

(82) Kraus, E. H., and Hunt, W. F. Tables for the determination of minerals by means of their physical properties, occurrences, and associates. 2nd edition. IX and 266 pages. McGraw-Hill Book Co., New York, 1930. Price, $3.00. The tables of this edition contain the names of a few more minerals and varieties.

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INDEX[1]

	Page
Alexanian, M. C. (49, 2)	37
Angenheister, G. (78, 9)	57
Austin, L. W. (71, 7)	51
Azerbeidjanskoe Neftianoe Khoziaystvo (editorial note) (70, 7)	50
Barton, Donald C. (73, 8)	52
Bohn, J. Lloyd (59, 5)	43
Bose, N. K. (77, 8)	56
Bowen, I. S. (63, 5)	46
Bowie, William (44, 1)	33
Chao, C. Y. (61, 5)	44
Engineering (editorial note) (53, 3)	40
Geological Society in Washington (72, 7)	51
Gilliland, T. R. (58, 5)	42
Golubiatnikov, D. (56, 4)	42
Golubiatnikov, D. (57, 4)	42
Haarmann, Erich (79, 9)	57
Heck, N. H. (47, 2)	35
Heck, N. H. (50, 3)	37
Hermanns, Hubert (80, 9)	57
Heyl, Paul R. (42, 1)	32
Hunt, W. F. (82, 9)	57
Janczewski, E. W. (68, 7)	49
Joly, John (81, 9)	57
Krauss, E. H. (82, 9)	57
McLaughlin, Donald H. (65, 7)	47
Millikan, Robert A. (62, 5)	45
Millikan, R. A. (63, 5)	46
Mining Journal (editorial note) (66, 7)	48
Morozewicz, J. (69, 7)	50
Orkisz, H. (48, 2)	36
Poletajev, S. P. (43, 1)	33
Putnam, George R. (45, 1)	34
Puzicha, Kurt (46, 2)	34

1 - The first figure refers to the number of the abstract; the second to the method of prospecting as indicated in the Table of Contents, and the third to the page.

Digitized by Google

	Page
Rieber, Frank (52, 3)	39
Rogers, Allen A. (54, 4)	40
Sarathy, R. Partha (74, 8)	52
Sarathy, R. Partha (75, 8)	54
Sarathy, R. Partha (76, 8)	55
Schulze, Walter M. H. (60, 5)	44
Stenz, E. (48, 2)	36
Strutt, M. J. O. (55, 4)	41
Suzuki, Takeo (51, 3)	38
Takeyama, Takeo (51, 3)	38
Teisseyre, W. (67, 7)	49
Whitney, Paul B. (64, 7)	46
Wilsdon, B. H. (74, 8)	52
Wilsdon, B. H. (75, 8)	54
Wilsdon, B. H. (76, 8)	55
Wilsdon, B. H. (77, 8)	56

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